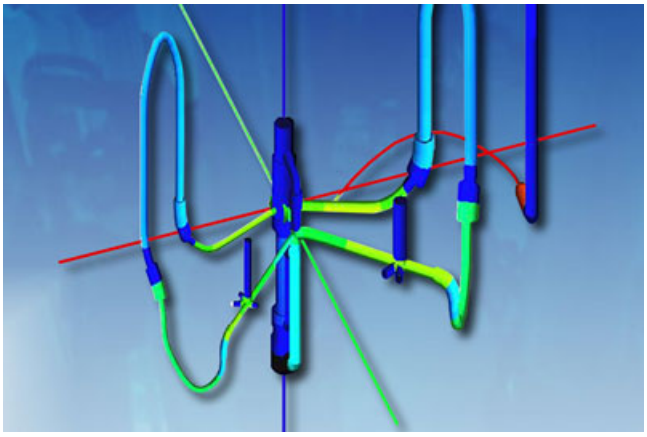


Components of a pressurized water reactor, as represented by RELAP5, a reactor modeling code. INL intern Riley Cumberland devised and published algorithm improvements that boost the program's processing speed.

Nuclear reactor modeling work nabs first publication for INL intern

By Nicole Stricker, *INL Communications & Governmental Affairs*

For North Carolina State University undergraduate Riley Cumberland, an Idaho National Laboratory internship two years ago is still paying dividends.

Cumberland, a nuclear engineering major at North Carolina State University, is the third INL intern to earn publication in the DOE undergraduate journal.

The nuclear engineering major is only a senior in college, but he's already bagged his first research publication. And he can take pride that his work has boosted the speed of a computer program used around the world for nuclear reactor design and operator training.

"My project felt very significant because the program is used throughout the nuclear industry," said Cumberland. "I was pretty excited to be working on it."

Last fall, Cumberland was one of only 20 undergraduates selected from among hundreds in the U.S. Department of Energy complex for publication in the DOE Office of Science's Journal of Undergraduate Research. In the journal's nine-year history, only two other INL interns have been published there.

Cumberland's research was published in the DOE Office of Science's 2009 Journal of Undergraduate Research, Volume IX.

"They looked at Riley's work and said 'Oh wow, this really is breaking new ground,'" said Cumberland's mentor, George Mesina.

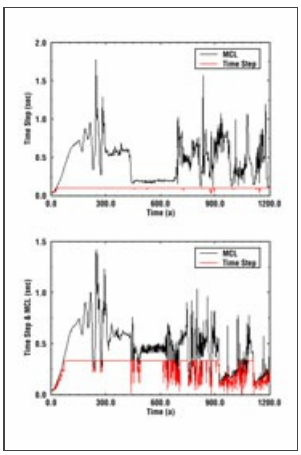
Mesina is INL's code architect for RELAP5, the fifth version of the Reactor Excursion and Leak Analysis Program. RELAP5 is a best-estimate reactor code that models the behavior of both the reactor core and reactor coolant.

The program is used at nuclear reactor facilities throughout the United States to model normal plant conditions, evaluate off-normal conditions, help design new reactors, and drive nuclear plant operator training simulations. And engineers around the world use it for nuclear reactor modeling and design.

Cumberland devised improvements to the software algorithm that helped it run faster without compromising the quality of the calculations.

"We found we could get the same level of accuracy and in some cases go 30 percent faster," said Mesina.

Cumberland's modeling and simulation work with INL's RELAP group sprung from DOE's Science Undergraduate Laboratory Internship (SULI) program. He did summer INL internships in both 2007 and 2008. He is now completing his nuclear engineering degree and will graduate this spring.



The black curves show

Although many are urging Cumberland to consider graduate school, he is setting his sights on a job with a nuclear reactor vendor. He wants to save graduate school for a time when he wants to adjust the course of his career.

For now, he is eager to begin work in the "real world" outside of academia's ivory tower and is preparing for NCSU's annual career fair. Regardless of where he heads next, Cumberland said he valued the experience of seeing a research project through to publication.

"It was a lot more involved than I thought it would be," he said of the publishing experience. "I thought it would be like a giant lab report — I didn't expect all the back and forth with the publisher."

stability limits on RELAP5's simulation speed. The red curves are actual performance speed, before (top) and after Cumberland's algorithm changes.